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Original Article

STUDIES ON EFFECT OF NUTRIENT AND IRRIGATION LEVELS ON GROWTH AND YIELD PARAMETERS, AND ON KAPAS YIELD OF COTTON IN SOUTHERN DRY ZONE OF KARNATAKA

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ABSTRACT

A field experiment was conducted during kharif season of 2016 at Zonal Agricultural Research Station, V. C. Farm, Mandya. The experiment was laid out under split plot design with 3 irrigation levels (0.6, 0.8 and 1.0 IW/CPE ratios) as main plots and 3 nutrient levels (75, 100 and 125% RDF-150:75:75 kg NPK/ha) as sub plots, and these treatments were replicated thrice. Irrigation at 0.8 IW/CPE ratio and nutrient level of 100 per cent RDF have significantly recorded higher growth and yield parameters viz, plant height, monopodial and sympodial branches, leaf area, LAI, dry matter production, stick yield and lint yield along with the kapas yield (22.94 and 22.49 q ha^{-1}, respectively) as compared to irrigation at 0.6 IW/CPE ratio and nutrient level of 75 per cent RDF, respectively. But, they were at par with irrigation at 1.0 IW/CPE ratio and nutrient level of 125 per cent RDF, respectively and found optimum in enhancing the cotton growth and kapas yield.

KEYWORDS: Kapas, Sympodial Branches, LAI & IW/CPE Ratio

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INTRODUCTION

Cotton is popularly called as "**White Gold**" and is considered as "**King of fiber crops**"**.** It is an important cash crop of global significance, which plays a dominant role in the world agriculture and industrial economy. Cotton is an important raw material for the Indian textile industry and contributes at least 65 per cent of its requirements. India is the largest producer of cotton and contributes 25.4 per cent to the world cotton production. India has the largest area (11.7 m ha) with 36.9 million bales production with an average productivity of 532 kg ha^{-1} (Anon, 2016). Gujarat is the leading producer (125 lakh bales) of cotton, followed by Maharastra (85 lakh bales) while, Tamil Nadu ranks first in productivity (1214 kg/ha).

The productivity of cotton in our country is low since, 70 per cent of the cotton is grown under rainfed condition. The external supply of irrigation water to the cotton crop has increased the cotton yield tremendously as reported by Sankaranarayanan *et al.* (2004). They have obtained 20 to 25 per cent higher seed cotton yield under irrigated condition over unirrigated crop. Along with the supply of irrigation, nutrients application also helps in getting enhanced yield. Application of all the three nutrients had effect on lint yield although most of the response was attributed to N (all cultivars) and to some extent P. The results for all quality factors suggest that K fertilization is a key to better quality (Kefyalew *et al,* 2007). The influence on optimum irrigation regime under different nutrients level in red sandy loamy soils of southern dry zone of Karnataka were revealed to be meager. Hence the present investigation is conducted to optimize the irrigation regime, nutrient levels and their interaction

for higher kapas yield of cotton.

MATERIALS AND METHODS

The field experiment was conducted during *kharif* season of 2016, from June to December in red sandy loam soil at Zonal Agricultural Research Station, Vishweshwaraiah Canal Farm, Mandya. The soil of the experimental site was sandy loam in texture. The soil was neutral in soil reaction with a pH of 7.27 and normal in electrical conductivity (0.38 dS/m). The organic carbon content was 0.46 per cent and low in available N (210.54 kg ha^{-1}), medium in available phosphorus (27.48 kg ha^{-1}) and available potassium (152.20 kg ha^{-1}). The experiment was laid out in split plot design with 3 irrigation levels (0.6, 0.8 and 1.0 IW/CPE ratios) as main plots and 3 nutrient levels (75, 100 and 125% RDF-150:75:75 kg NPK/ha) as sub plots, and these treatments were replicated thrice.

Cotton hybrid "Varalakshmi' (DCH-32) was used in the experiment sown at a spacing of 90 cm × 60 cm. The fertilizers were applied as per the treatments through soil application, in which 50 per cent of N and full dose of P and K were applied at as basal dose. Remaining 50 per cent of N was top dressed in two splits at 50 DAS (25% N) and at 75 DAS (25% N). Irrigation was given by quantifying through water meter using the IW/CPE relation by fixing the IW (irrigation water) as 60 mm depth. Necessary plant protection measures were taken for the control of sucking pests like aphids, thrips and white flies.

RESULTS AND DISCUSSIONS

Growth and Yield Parameters

The experimental data (Table 1) indicates that, irrigation at 1.0 IW/CPE ratio was recorded significantly higher plant height at 150 DAS (154.47 cm), monopodial and sympodial branches (2.35 and 20.11/plant, respectively) at harvest, dry matter production $plant^{-1}$ at 120 DAS (376.21 g/plant) over irrigation at 0.6 IW/CPE ratio (136.28 cm, 1.55 and 14.01/plant and 296.19 g/plant, respectively). However, it was at par with irrigation at 0.8 IW/CPE ratio (150.33 cm, 2.19 and 17.54/plant and 347.47 g/plant, respectively). Among the different nutrient levels, 125 per cent RDF was recorded significantly higher plant height at 150 DAS (150.00 cm), monopodial and sympodial branches (2.27 and 19.23/plant, respectively) at harvest, dry matter production $plant^{-1}$ at 120 DAS (372.27 g/plant) over 75 per cent of RDF (135.35 cm, 1.77 and 14.81/plant and 299.18 g/plant, respectively). However, it was at par with 100 per cent of RDF (145.73 cm, 2.06 and 17.63/plant and 348.42 g/plant, respectively). The data presented in Table 2 indicates that the irrigation at 1.0 IW/CPE ratio was recorded significantly higher leaf area at 120 DAS (18521.85 cm^2/plant), leaf area index at 120 DAS (3.43) and stick yield (33.81 q/ha) over irrigation at 0.6 IW/CPE ratio (13914.53 cm^2/plant, 2.58 and 29.24 q/ha, respectively). However, it was at par with irrigation at 0.8 IW/CPE ratio (17002.41 cm^2/plant, 3.15 and 32.68 q/ha, respectively).

Among the different nutrient levels, 125 per cent RDF ratio was recorded significantly higher leaf area at 120 DAS (17888.29 cm^2/plant), leaf area index at 120 DAS (3.31) and stick yield (33.17 q/ha) over 75 per cent RDF (14780.44 cm^2/plant, 2.74 and 30.31 q/ha). However, it was at par with 100 per cent of RDF (16700.05 cm^2/plant, 3.11 and 32.12 q/ha). This was due to higher frequency of irrigation, which led to better availability and uptake of nutrients as well as their partition to different parts.

These results are in line with the findings of Srinivasan and Aananthi (2017), Yang *et al.* (2015) and Ghonganee*t al.* (2009). Increase in growth attributes was also due to higher quantity of nutrients coupled with good available moisture leading to better uptake and partition. In addition, nitrogen has crucial role in cell division and elongation there by

increased the plant height. Phosphorus might have influenced better root growth there by increased uptake of nutrients and water. Better phosphorus management helps in diversion of plant metabolites towards the developing buds, flowers and bolls, and also the translocation of more photosynthates towards the sink and consequent development of yield attributes as reported by Seema*et al.* (2012). Higher quantity of nutrient supply at the initial stages is also one of the reasons for enhanced growth parameters. These results also agree with the findings of Gundlur*et al.* (2013), Ghonganee*t al.* (2009).

There was no significant difference in plant height, monopodial branches, sympodial branches and dry matter production due to combined effect of nutrient and irrigation levels. These results are in line with the findings of Gundlur*et al.* (2013).

Kapas and Lint Yield

Different nutrient and irrigation levels had a significant effect on kapas and lint yield of cotton (Table 2). Irrigation at 1.0 IW/CPE ratio was recorded significantly higher kapas and lint yield of cotton (24.37 and 8.69 q/ha, respectively) over irrigation at 0.6 IW/CPE ratio (15.91 and 5.25 q/ha, respectively). However, it was at par with irrigation at 0.8 IW/CPE ratio (22.94 and 8.12 q/ha, respectively). Among the different nutrient levels, 125 per cent RDF was recorded significantly higher kapas and lint yield of cotton (23.55 and 8.35 q/ha, respectively) over 75 per cent RDF (17.18 and 5.83, respectively). However, it was at par with 100 per cent of RDF (22.49 and 7.88 q/ha, respectively). This was due to increased growth parameters, yield attributes and dry matter production as well as its partition to different parts due to combined effect of N, P and K with frequent irrigations. Higher sympodial branches leading to higher boll number and boll weight might have enhanced seed cotton yield. The leaf growth continued even at boll development stage and higher dry matter accumulation in the fruiting bodies at the later stages of the crop growth were also the reason for higher yield. These results are in conformity with the findings of Deepa and Aladakatti (2016), Amandeep*et al.* (2015), Gundlur*et al.* (2013).

Table 1: Effect of Nutrient and Irrigation Levels on Plant Height, Monopodialbranchs, Sympodial Branches and Dry Matter Production

Treatment	Parameters			
	Plant Height (Cm) at 150 DAS	**Monopodial Branches Plant^{-1} at Harvest**	**Sympodial Branches Plant^{-1} at Harvest**	**Dry Matter Production Plant^{-1} (G) at 120 DAS**
Irrigation levels				
I_1: IW/CPE = 0.6	136.28	1.55	14.01	296.19
I_2: IW/CPE = 0.8	150.33	2.19	17.54	347.47
I_3: IW/CPE = 1.0	154.47	2.35	20.11	376.21
SEm. ±	**1.97**	**0.06**	**0.68**	**7.97**
C. D. @ 5%	**7.73**	**0.23**	**2.65**	**31.21**
Nutrient levels				
F_1: 75 % RDF	135.35	1.77	14.81	299.18
F_2: 100 % RDF	145.73	2.06	17.63	348.42
F_3: 125 % RDF	150.00	2.27	19.23	372.27
SEm. ±	**1.85**	**0.07**	**0.66**	**7.23**
C. D. @ 5%	**7.26**	**0.26**	**2.58**	**28.31**
Irrigation levels × Nutrient levels				
SEm. ±	**3.04**	**0.08**	**0.84**	**10.38**
C. D. @ 5%	**NS**	**NS**	**NS**	**NS**

Note: DAS: Days after sowing, **IW**: Irrigation water, **CPE**: Cumulative pan evaporation,

RDF: Recommended dose of fertilizers (150:75:75 Kg NPK/ha)

Table 2: Effect of Nutrient and Irrigation Levels on Leaf Area, Leaf Area Index (LAI), Stick Yield, Lint Yield and Kapas Yield

Treatment	Parameters				
	Leaf area (cm^2/plant) at 120 DAS	LAI at 120 DAS	Stick yield (q/ha)	Kapas yield(q/ha)	Lint yield (q/ha)
Irrigation levels					
I_1: IW/CPE = 0.6	13914.53	2.58	29.24	15.91	5.25
I_2: IW/CPE = 0.8	17002.41	3.15	32.68	22.94	8.12
I_3: IW/CPE = 1.0	18521.85	3.43	33.81	24.37	8.69
SEm. ±	**743.85**	**0.14**	**0.70**	**0.43**	**0.21**
C. D. @ 5%	**2911.53**	**0.54**	**2.73**	**1.69**	**0.81**
Nutrient levels					
F_1: 75 % RDF	14780.44	2.74	30.31	17.18	5.83
F_2: 100 % RDF	16770.05	3.11	32.12	22.49	7.88
F_3: 125 % RDF	17888.29	3.31	33.17	23.55	8.35
SEm. ±	**476.52**	**0.09**	**0.39**	**0.83**	**0.25**
C. D. @ 5%	**1865.16**	**0.35**	**1.51**	**3.25**	**0.97**
Irrigation levels × Nutrient levels					
SEm. ±	**1161.70**	**0.22**	**0.83**	2.57	**0.85**
C. D. @ 5%	**NS**	**NS**	**NS**	**NS**	**NS**

Note: DAS: Days after sowing, **IW**: Irrigation water, **CPE**: Cumulative pan evaporation,

RDF: Recommended dose of fertilizers (150:75:75 Kg NPK/ha)

CONCLUSIONS

The experimental data revealed that irrigating the cotton at IW/CPE ratio of 0.8 was found optimum and recorded significantly higher seed cotton yield (22.94 q/ha) similar to that of IW/CPE ratio of 1.0 and application of 100 per cent RDF (150:75:75 kg NPK/ha) was found optimum and recorded significantly higher seed cotton yield (22.49 q/ha) similar to that of 125 per cent RDF.

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